

Southwest Division
Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway, Building 127, Room 112
San Diego, California 92132-5190


CONTRACT NO. N68711-04-D-1104
CTO No. 0003

FINAL
WORK PLAN FOR ADDITIONAL GROUNDWATER
MONITORING AT UST SITE 1106
MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA
Revision 2
July 26, 2005

DCN: SES-TECH-05-0044

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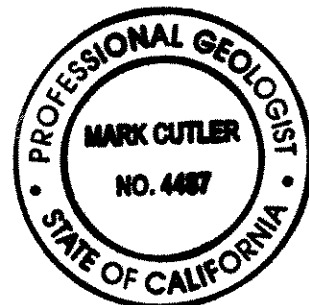


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ABBREVIATIONS AND ACRONYMS

bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CTO	Contract Task Order
DEH	Department of Environmental Health
EPA	U.S. Environmental Protection Agency
ETBE	ethyl tert-butyl ether
ID/IQ	Indefinite Delivery/Indefinite Quantity
MCB	Marine Corps Base
mg/kg	milligrams per kilogram
MTBE	methyl tert-butyl ether
NFECSSW	Southwest Division, Naval Facilities Engineering Command
OHM	OHM Remediation Services Corporation
PAH	polynuclear aromatic hydrocarbon
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RWQCB	Regional Water Quality Control Board
SAM	Site Assessment and Mitigation
SAP	Sampling and Analysis Plan
SHSP	Site-Specific Health and Safety Plan
TBA	tert-butyl alcohol
TAME	tert-amyl methyl ether
TPH-d	total petroleum hydrocarbons quantified as diesel
TPH-g	total petroleum hydrocarbons quantified as gasoline
UST	Underground Storage Tank
VOC	volatile organic compound

1.0 INTRODUCTION

This Work Plan for Additional Groundwater Monitoring (Plan) describes proposed field activities for obtaining additional groundwater data at Underground Storage Tank (UST) Site 1106 at Marine Corps Base (MCB) Camp Pendleton, California. The work is being completed based on comments received from the Regional Water Quality Control Board (RWQCB), San Diego Region in a letter dated October 1, 2004 (RWQCB, 2004). This Plan was prepared by SES-TECH, a joint venture between Sealaska Environmental Services LLC and Tetra Tech FW, Inc., under the Southwest Division, Naval Facilities Engineering Command (NFECSW) Indefinite Delivery/Indefinite Quantity (ID/IQ) Environmental Remediation Contract No. N68711-04-D-1104, Contract Task Order (CTO) No. 0003.

UST Site 1106 is regulated under the California Code of Regulations, Title 23, Division 3, Chapter 16, Article 11, and the California Health and Safety Code, Sections 25187 through 25189, which require those responsible for the release of hazardous substances to take all necessary corrective actions to remedy the release. The document guiding groundwater monitoring at the Site is the *San Diego County Site Assessment and Mitigation Manual [SAM] 2005* [Department of Environmental Health (DEH), 2005].

UST Site 1106 is located in MCB Camp Pendleton Area 11 on 13th Street, between Vandergrift and E Street (Figure 1-1). UST Site 1106 formerly contained one 2,000-gallon fiberglass tank used to store diesel fuel for a boiler system. On September 28, 1994, the tank failed tightness testing, with results indicating a leak in the piping. On June 8, 1995, the tank and approximately 30 feet of supply piping were removed in the presence of a County of San Diego SAM Division Inspector.

1.1 OBJECTIVE

The primary objective of this project is to evaluate groundwater quality at UST Site 1106, MCB Camp Pendleton. Project tasks include the following:

- Complete one round of groundwater sampling from three existing wells.
- Submit a Groundwater Monitoring Report summarizing the findings of the groundwater monitoring and, if necessary, include a case closure summary.

1.2 SITE IDENTIFICATION

The following is a list of site identification data:

Site Address:	Building 1106, Camp Pendleton, California 92055
Facility Name:	Marine Corps Exchange
DEH Case No.:	H05939-210, H05939-196
RWQCB Case No.:	9UT3062
Property Owner:	United States Marine Corps
Contact Person:	Mr. Chet Storrs Assistant Chief of Staff, Environmental Security Box 555008, Building 22165 Camp Pendleton, California 92055-5008 (760) 725-9774
Remedial Project Manager:	Mr. Bipin Patel, P.E. Naval Facilities Engineering Command, Southwest Division 1220 Pacific Highway San Diego, California 92132-5190 (619) 532-4814
Responsible Party:	United States Marine Corps

1.3 PLAN ORGANIZATION

This Plan is organized as follows:

- **Section 1.0** – Introduction
- **Section 2.0** – Site Description and Background
- **Section 3.0** – Groundwater Sampling Activities
- **Section 4.0** – Waste Management (describes waste management requirements for the proposed field activities)
- **Section 5.0** – References
- **Appendix A** – Sampling and Analysis Plan (SAP)

The SAP (Appendix A) describes field sampling procedures, quality assurance (QA) and quality control (QC) requirements, and data gathering methods that will be used to support groundwater sampling activities. A separate Site-Specific Health and Safety Plan (SHSP) (SES-TECH, 2005) for multiple CTO No. 0003 sites has been prepared to support not only the health and safety procedures associated with the proposed field activities at UST Site 1106, but all field activities associated with CTO No. 0003.

2.0 SITE DESCRIPTION AND BACKGROUND

UST Site 1106 is located at an asphalt loading dock behind Building 1106. Building 1106 currently houses the MCB Main Exchange. UST Site 1106 contained one 2,000-gallon fiberglass tank used to store diesel fuel for a boiler system. On June 8, 1995, following a failed tank integrity test, the tank and approximately 30 feet of supply piping were removed in the presence of a County of San Diego SAM Division Inspector.

The tank was approximately 6.25 feet in diameter and 8.7 feet long. The tank bottom was approximately 10 feet below ground surface (bgs). Supply and return pipelines extended approximately 30 feet to the building at a depth of approximately 2.5 feet bgs. Excavation dimensions were approximately 10 feet by 12 feet and approximately 10 feet in depth around the tank and approximately 30 feet by 2 feet and 2.5 feet in depth beneath the supply pipe.

Following the UST removal excavation, the SAM Division Inspector directed soil sampling activities at UST Site 1106. Soil samples were collected from the bucket of the backhoe during this investigation. Samples were analyzed for total petroleum hydrocarbons (TPH) quantified as gasoline (TPH-g) and total petroleum hydrocarbons quantified as diesel (TPH-d) using U.S. Environmental Protection Agency (EPA) Method 8015 Modified. The sample with the highest TPH result was also analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX) using EPA Method 8020. Two soil samples were collected in the tank cavity and one was collected in the piping trench.

Soil samples were collected from the northwest and south sidewalls of the excavation at a depth of approximately 10 feet bgs. Sample results were non-detect for both TPH-d and TPH-g.

The soil sample collected in the pipeline trench at approximately 2.5 feet bgs contained 3,480 milligrams per kilogram (mg/kg) of TPH-d. Results from TPH-g and BTEX analysis were non-detect. Based on analytical results from this sample, over-excavation of the piping trench was conducted on June 15, 1995. The trench was excavated to 5 feet bgs and a sample was collected beneath the location of the original sample. This sample resulted in a concentration of 845 mg/kg of TPH-d. The trench was then excavated to 6.5 feet bgs on June 21, 1995, and a third sample was collected beneath the location of the previous samples. TPH-d was reported at a concentration of 62 mg/kg. Analytical results from tank excavation sampling are shown on Table 2-1.

Following the tank removal, the tank excavation and trenches were backfilled with clean imported fill material.

During tank removal, groundwater was encountered at a depth of 8 feet bgs. The information presented above was obtained from the OHM Remediation Services Corporation (OHM) Removal of USTs Report (OHM, 1995).

3.0 GROUNDWATER SAMPLING ACTIVITIES

This section summarizes the procedures for the sampling and analysis of groundwater monitoring wells at UST Site 1106. One sampling event will be conducted after RWQCB approval of this Plan.

3.1 GROUNDWATER SAMPLING AND ANALYSES

It is anticipated that the groundwater monitoring event at UST Site 1106 will be conducted during the second quarter of 2005. Groundwater samples will be collected from three existing groundwater monitoring wells. Locations of the monitoring wells are depicted in Figure 2-1. During this monitoring event, groundwater from each of the monitoring wells will be analyzed for TPH-d; volatile organic compounds (VOCs), including BTEX; methyl tert-butyl ether (MTBE); and other oxygenates [such as di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE), tert-amyl methyl ether (TAME), and tert-butyl alcohol (TBA)]; and polynuclear aromatic hydrocarbons (PAHs). All sampling, sample handling, and proposed analytical procedures are described in the SAP (Appendix A).

4.0 WASTE MANAGEMENT

This section summarizes the handling and disposal methods for well purge water, equipment decontamination water, and personal protective equipment (PPE).

4.1 PPE AND LIQUIDS DISPOSAL

All used PPE will be stored in trash bags and later disposed of at a proper landfill. Wastewater generated from well purging and equipment decontamination will be stored in Department of Transportation-approved 55-gallon drums or portable storage tanks. All drums and/or tanks will be labeled once accumulation has begun and stored on site away from high use and high traffic areas. Wastewater will be sampled and analyzed, as necessary, and transported to an appropriate off- site disposal and/or treatment facility. All wastes will be disposed of within 60 days from the start of accumulation.

5.0 REFERENCES

- California Region Water Quality Control Board (RWQCB), San Diego Region. 2004. *Letter to the Office of the Assistant Chief of Staff – Environmental Security*. Reference: SMC:50-3062.05:grifb. October 1.
- OHM Remediation Services Corporation (OHM). 1995. *Removal of Underground Storage Tanks Various Locations Marine Corps Base Camp Pendleton, California*.
- San Diego County Department of Environmental Health (DEH), Land and Water Quality Division. 2005. *San Diego County Site Assessment and Mitigation Manual 2005*.
- SES-TECH. 2005. *Final Site-Specific Health and Safety Plan, Remediation of USTs in Areas 11, 14, 16, and 33*. Revision 0. April 8.

TABLES

TABLE 2-1
SOIL ANALYSIS RESULTS AT UST SITE 1106

Sample ID	Depth (feet bgs)	Sample Location	TPH-g ^(a) (mg/kg)	TPH-d ^(a) (mg/kg)	Benzene ^(b) (µg/kg)	Toluene ^(b) (µg/kg)	Ethylbenzene ^(b) (µg/kg)	Xylenes ^(b) (µg/kg)
1106-S-128	2.5	Trench	ND	3,480	ND	ND	ND	ND
1106-S-129	10	North Sidewall	ND	ND	NA	NA	NA	NA
1106-S-130	10	Southeast Sidewall	ND	ND	NA	NA	NA	NA
1106-S-168	5	Trench	NA	845	NA	NA	NA	NA
1106-S-170	6.5	Trench	NA	62	NA	NA	NA	NA

Notes:

(a) Detection limit 10 mg/kg

(b) Detection limit 5 µg/kg

bgs – below ground surface

mg/kg – milligrams per kilogram

µg/kg – micrograms per kilogram

NA – not analyzed

ND – not detected

TPH-g – total petroleum hydrocarbons quantified as gasoline

TPH-d – total petroleum hydrocarbons quantified as diesel

UST – Underground Storage Tank

Source: OHM Remediation Services Corporation, 1995

FIGURES

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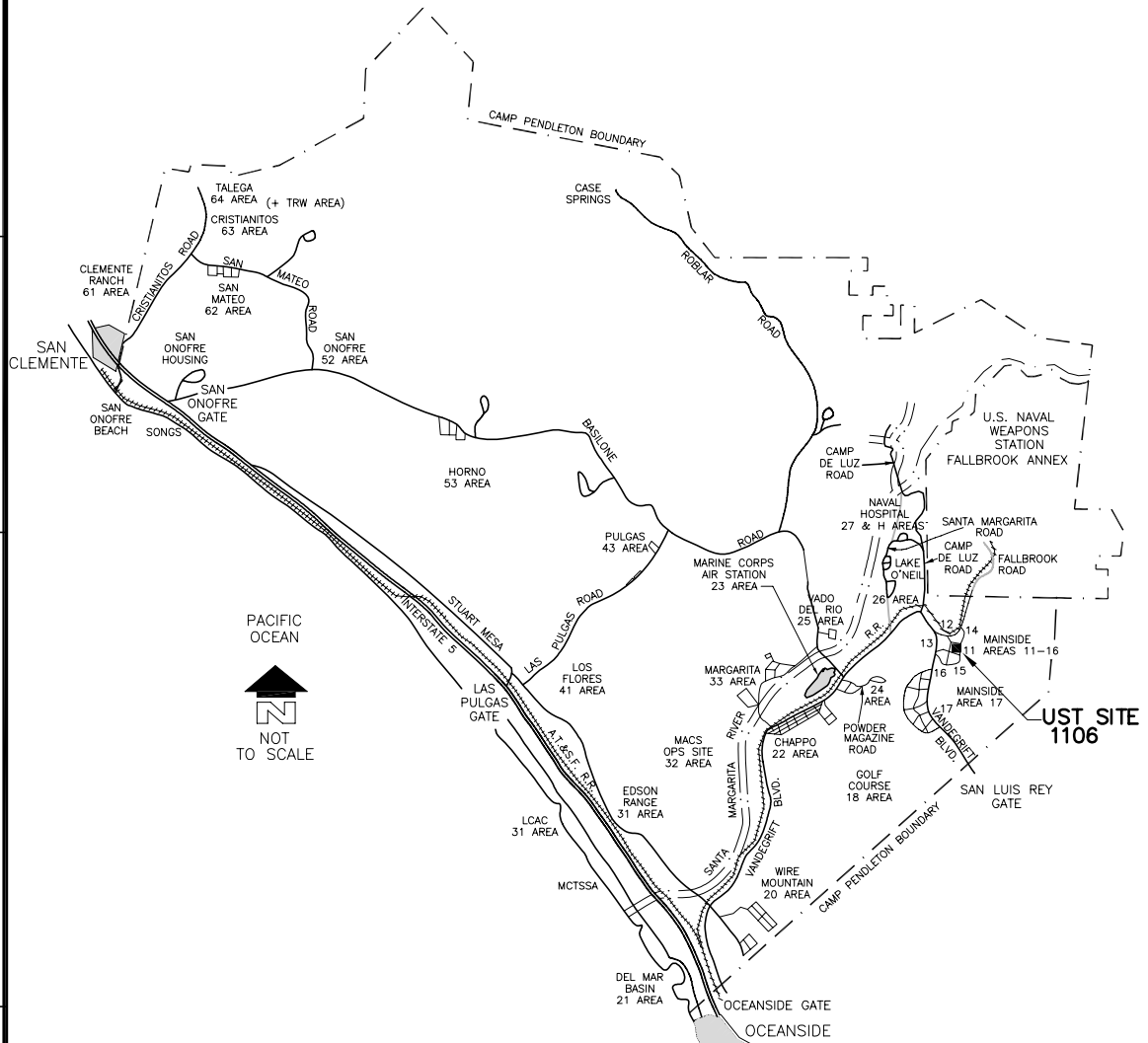
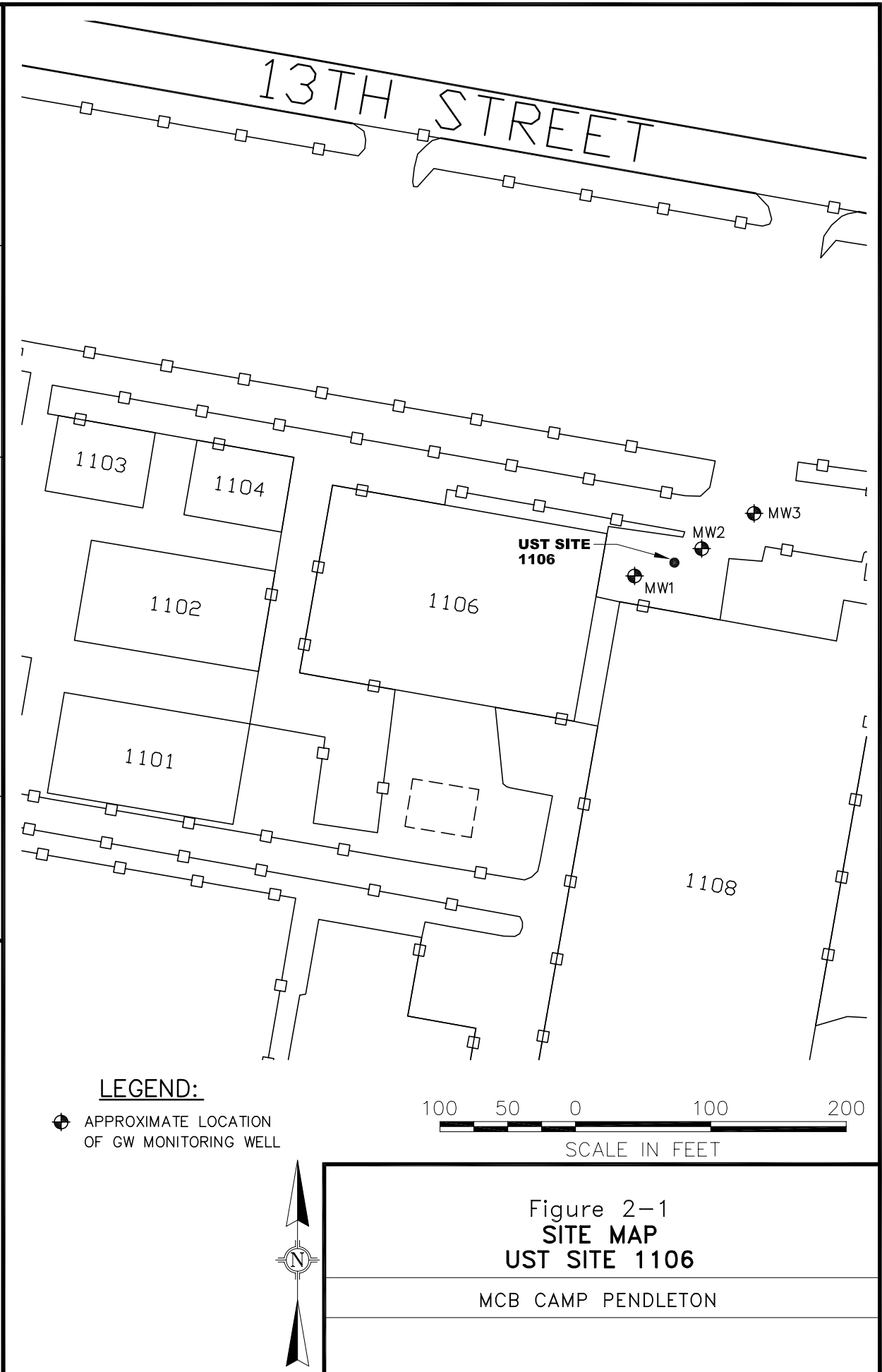


Figure 1-1
SITE LOCATION MAP

MCB CAMP PENDLETON

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DATE: 04/15/05	REV: REVISION 0		CTO: #003	



APPENDIX A

SAMPLING AND ANALYSIS PLAN

Southwest Division
Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway, Building 127, Room 112
San Diego, CA 92132-5190

CONTRACT NO. N68711-04-D-1104
CTO No. 0003

APPENDIX A

FINAL

**SAMPLING AND ANALYSIS PLAN
UST SITE 1106, MCB CAMP PENDLETON
(Field Sampling Plan and Quality Assurance Project Plan)
Revision 2
July 26, 2005**

**MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA**

DCN: SES-TECH-05-0044

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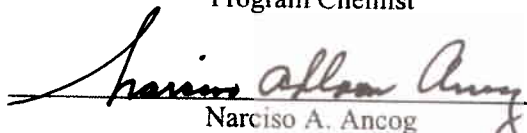
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ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
%R	percent recovery
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CCV	continuing calibration verification
CDQMP	Chemical Data Quality Management Plan
CFR	Code of Federal Regulations
COC	chain-of-custody
CTO	Contract Task Order
DEH	Department of Environmental Health
DHS	Department of Health Services
DIPE	di-isopropyl ether
DO	dissolved oxygen
DoD	Department of Defense
DON	Department of the Navy
DOT	Department of Transportation
DQO	data quality objective
EDCC	Electronic Data Consistency Checker
EDD	electronic data deliverable
EDF	electronic data format
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency
ETBE	ethyl tert-butyl ether
EWI	Environmental Work Instruction
GC/MS	gas chromatograph/mass spectrometer
ICAL	initial calibration
ID/IQ	Indefinite Delivery/Indefinite Quantity
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MCB	Marine Corps Base
MDL	method detection limit

ABBREVIATIONS AND ACRONYMS

(Continued)

mg/L	milligrams per liter
mL	milliliter
MS	matrix spike
MSA	Method of Standard Addition
MSD	matrix spike duplicate
MTBE	methyl tert-butyl ether
NaHSO ₄	sodium bisulfate
NCR	Nonconformance Report
NFECSSW	Southwest Division, Naval Facilities Engineering Command
NFESC	Naval Facilities Engineering Service Center
NIST	National Institute for Standards and Testing
ORP	oxidation/reduction potential
PAH	polynuclear aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability
PID	photoionization detector
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RL	reporting limit
RPD	relative percent difference
ROICC	Resident Officer in Charge of Construction
RWQCB	Regional Water Quality Control Board
SAM	Site Assessment and Mitigation
SAP	Sampling and Analysis Plan
SES-TECH	Sealaska Environmental Services LLC and Tetra Tech FW, Inc.
SIM	Selective Ion Monitoring
SOP	standard operating procedure
TAME	tert-amyl methyl ether
TBA	tert-butyl alcohol
TPH-d	total petroleum hydrocarbons quantified as diesel

ABBREVIATIONS AND ACRONYMS

(Continued)

UST	Underground Storage Tank
VOA	volatile organic analysis
VOC	volatile organic compound

ELEMENTS OF EPA QA/R-5 IN RELATION TO THIS SAP

EPA QA/R-5 QAPP Element ^a	SES-TECH SAP
A1 Title and Approval Sheet	Title and Approval Sheet
A2 Table of Contents	Table of Contents
A3 Distribution List	Distribution List
A4 Project/Task Organization	7.0 Project Organization
A5 Problem Definition/Background	2.0 Background
A6 Project/Task Description	2.0 Background
A7 Quality Objectives and Criteria	8.0 Quality Assurance Objectives
A8 Special Training/Certification	8.2.1 Laboratory Qualifications
A9 Documents and Records	6.8 Field Documentation and Records
B1 Sample Process Design	6.1 Groundwater Sampling Procedures
B2 Sampling Methods	6.0 Field Methods and Sampling Procedures
B3 Sample Handling and Custody	8.2.2 Laboratory Sample Custody and Documentation
B4 Analytical Methods	5.1 Analytical Methods
B5 Quality Control	8.2 Analytical Data Quality Objectives 5.3 Field Quality Control Samples
B.6 Instrument/Equipment Testing, Inspection, and Maintenance	8.2.3 Laboratory Quality Control Procedures 8.2.4.10 Preventative Maintenance
B7 Instrument/Equipment Calibration and Frequency	8.2.4.1 Calibration
B8 Inspection/Acceptance of Supplies and Consumables	9.2.1 Hard-copy Report
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B10 Data Management	9.0 Data Management
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D1 Data Review, Verification, and Validation	9.1 Laboratory Data Review 9.4 Data Evaluation
D2 Verification and Validation Methods	9.3 Data Validation
D3 Reconciliation with User Requirements	8.1 Data Quality Objectives

Notes:

^a EPA. 2001. *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, QAMS*. March.

EPA – U.S. Environmental Protection Agency

QA – quality assurance

QAPP – Quality Assurance Project Plan

SAP – Sampling and Analysis Plan

SES-TECH – Sealaska Environmental Services LLC and Tetra Tech FW, Inc.

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared for the Department of the Navy (DON) by SES-TECH, a joint venture between Sealaska Environmental Services LLC and Tetra Tech FW, Inc., under the Southwest Division, Naval Facilities Engineering Command (NFECSW) Indefinite Delivery/Indefinite Quantity (ID/IQ) Environmental Remediation Contract No. N68711-04-D-1104. The purpose of this SAP is to provide guidance on sampling, analysis, and quality assurance (QA) for groundwater sampling at Underground Storage Tank (UST) Site 1106 at the Marine Corps Base (MCB) Camp Pendleton, California.

This SAP will be used as a reference document by all field and laboratory personnel engaged in the sampling and analysis for this project. The SAP was prepared in accordance with the *Final Program Chemical Data Quality Management Plan* (CDQMP) (SES-TECH, 2005a). Included in this SAP are field sampling procedures, QA/quality control (QC) requirements, and data gathering methods that will be used during this project. Data quality objectives (DQOs) are also provided in this document. The QA elements of this SAP were prepared in accordance with the *EPA Requirements for Quality Assurance Project Plans*, *EPA QA/R-5*, *QAMS* [U.S. Environmental Protection Agency (EPA), 2001] to ensure that all data collected are precise, accurate, representative, complete, and comparable to meet their intended use.

1.1 OBJECTIVE

The objectives of this SAP are to: 1) provide guidance for the field sampling activities at the site; 2) describe and establish consistent field sampling procedures; 3) establish data gathering, handling, and documentation methods; and 4) define QA/QC measures to ensure consistency and confidence in the data obtained.

The primary objective is to evaluate groundwater quality at UST Site 1106 at MCB Camp Pendleton. Other specific objectives will include the following:

- Collecting and analyzing groundwater samples at least once from three existing monitoring wells to evaluate groundwater quality
- Determine depth to groundwater in each well and the groundwater flow direction
- Conducting waste characterization sampling of project-derived wastes generated during field activities for disposal purposes, as necessary

1.2 REGULATORY OVERSIGHT

The DON is the lead agency responsible for the project, and the California Regional Water Quality Control Board, San Diego Region (RWQCB) is the lead regulatory agency.

2.0 BACKGROUND

Site location and background, including a site description and previous site activities are presented in Sections 1.0 and 2.0 of the Work Plan. Information presented in the Work Plan will not be duplicated here.

3.0 MAPS

Maps showing the site location and groundwater monitoring well locations are depicted in Figures 1-1 and 2-1 of the Work Plan, respectively.

4.0 SAMPLING STRATEGY

This section describes the collection and analysis of groundwater samples to meet the project objectives during field activities.

4.1 GROUNDWATER SAMPLING

Groundwater samples will be collected from three existing groundwater monitoring wells. Location of the monitoring wells are depicted in Figure 2-1 of the Work Plan. Groundwater samples will be analyzed for total petroleum hydrocarbons quantified as diesel (TPH-d); volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, and total xylenes (BTEX); methyl tert-butyl ether (MTBE); and other oxygenates [such as di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE), tert-amyl methyl ether (TAME), and tert-butyl alcohol (TBA)]; and polynuclear aromatic hydrocarbons (PAHs). Groundwater samples will be compared to the reporting limits discussed in Section 8.4. Groundwater samples will be collected in accordance with procedures in Section 6.1.

4.2 WASTE CHARACTERIZATION SAMPLING

Waste generated during site activities will consist of purge water and decontamination water, which will be stored on site in 55-gallon drums. Drums will be labeled and placed in a secure area. Analytical results from this and previous site assessment activities will be used for profiling the waste. Additional analyses will not be performed on the waste for characterization, unless required by the disposal facility. Sampling procedures are described in Section 6.2.

Personal protective equipment (PPE) will not be sampled for waste characterization, but will be characterized based on knowledge of the process generating the waste. The results of the groundwater sampling will be used to classify the PPE.

5.0 REQUEST FOR ANALYSIS

This section describes the analytical methods, sample containers, and preservative requirements. Additionally, field QC samples to be collected for this project will be discussed in this section.

5.1 ANALYTICAL METHODS

The following EPA analytical methods [*Test Methods for Evaluating Solid Waste, Physical Chemical Methods, SW-846*, Third Edition and final updates (EPA, 1986)] will be used to analyze water samples during this project.

- TPH-d by EPA Method 3520C/8015B for groundwater, decontamination water samples, and equipment rinsates
- VOCs by EPA Method 5030B/8260B for groundwater, decontamination water samples, and equipment rinsates
- PAHs by EPA Method 3520C/8270C Selective Ion Monitoring (SIM) for groundwater, decontamination water samples, and equipment rinsates (EPA Method 3520C/8310 will be used if EPA 3520C/8270C SIM RLs cannot support action levels as listed in Section 8.2.2)

Detailed information on methods, calibration criteria, project-required RLs, and QC acceptance criteria are presented in Section 8.0.

5.2 SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

Sample containers, preservatives, and holding time requirements will be in accordance with the EPA requirements presented in Table A.5-1. The subcontractor laboratory will provide sample containers that are certified pre-cleaned according to EPA protocols. The laboratory will guarantee the purity of preservation chemicals.

5.3 FIELD QUALITY CONTROL SAMPLES

Field QC samples will be collected and analyzed during the project to assess the consistency and performance of the sampling program. Field QC samples are necessary for establishing data comparability, determining the total measurement error (the overall precision of the measurement system from sample collection to analysis) and for QA during sample handling and shipment. Field QC samples will include field duplicates, equipment rinsates, source blanks, trip blanks, and temperature blanks. QA samples, which are the splits of the primary samples, may be also collected if justified by the project DQO. Field QC samples will not be applicable to the collection of waste characterization samples.

5.3.1 Field Duplicates

Field duplicates consist of two distinct samples (an original and a duplicate) of the same matrix collected at the same time and location to the extent possible and using the same sampling techniques. The purpose of field duplicates is to measure the consistency of field sampling. Field duplicates will be collected at a frequency of one for every ten samples taken and will be analyzed for the same analytes as the original sample. Field duplicates are uniquely identified so that the identity of the field duplicates is “blind” to the analytical laboratory. Exact locations of field duplicate samples and their identifications will be recorded in the field logbook.

5.3.2 Equipment Rinsate Samples

Equipment rinsate is a sample of analyte-free water collected from a final rinse of sampling equipment after the decontamination procedure has been performed. Rinsate samples will be collected directly from the sampling equipment, placed in appropriate pre-cleaned containers supplied by the analytical laboratory, and analyzed for the same analytes as the field samples under the same analytical conditions. Equipment rinsate samples, collected at a frequency of one per each day of sampling, will be collected after sampling the most contaminated well (based on historical data or field observations) and will help determine the effectiveness of the decontamination procedure and potential for cross-contamination during sampling events.

5.3.3 Source Blank Samples

A source blank consists of analyte-free, reagent-grade water provided by the laboratory to be used for the collection of equipment rinsate samples as described in Section 5.3.2. In order to assure that the source blank is free of contamination, one of two courses of action will be followed before the source blank water is used. First, the laboratory will be asked to provide a certificate of analysis that the water provided for the equipment rinsate samples does not contain analytes above the project RLs. If the laboratory cannot provide a certificate of analysis, then a sample of the laboratory water will be collected at the beginning of the project and analyzed for the same parameters as the equipment rinsate samples to verify that the results are not above the project RLs. Source blank samples will only be collected if equipment rinsate samples are to be collected for the project.

5.3.4 Trip Blanks

Trip blanks are hydrochloric acid-preserved, analyte-free, deionized water prepared by the laboratory in 40-milliliter (mL) volatile organic analysis (VOA) vials that will be carried to the field, stored with the samples, and returned to the laboratory for VOC analysis. Trip blanks will be used to determine if samples have been cross-contaminated with VOCs during sample transportation to the laboratory. One trip blank will be provided in each cooler, which contains samples for VOC analysis.

5.3.5 Temperature Blanks

Temperature blanks are containers of tap water that will be shipped in each cooler containing field samples and ice. Laboratory personnel will use temperature blanks to measure the temperature of the cooler upon arrival at the laboratory.

6.0 FIELD METHODS AND SAMPLING PROCEDURES

The following sections provide the sampling procedures and sample handling procedures to be used for this project.

6.1 GROUNDWATER SAMPLING PROCEDURES

Groundwater sampling will be performed as described in the following sections.

6.1.1 Water Level Measurement Procedure

Water level measurements will be recorded from the wells before sampling. The following procedure will be used to obtain water level measurements:

1. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting water level measurements at each well.
2. The water level probe will be decontaminated as described in Section 6.3.
3. The probe will be lowered slowly until the instrument alarm indicates that the water surface has been encountered. The measurement will be taken from the surveyed point mark on the top of the well casing.
4. The measurement will be checked by slowly raising and lowering the tape and watching the instrument response. Three consecutive water level readings within 0.01 feet will be observed prior to recording the depth to water. The final measurement will be recorded in the field logbook.
5. After recording the water level measurement, the probe will be lowered to the bottom of the well to determine the total well depth. The measurement will be taken from the surveyed point mark on the top of the well casing. The final well depth measurement will be recorded in the field logbook.
6. After withdrawing the probe from the well, the decontamination procedure described in Section 6.3 will be followed to prevent cross-contamination.
7. This procedure will be modified to meet the operational requirements of an oil/water interface probe in wells where two phases are present or expected.

6.1.2 Well Purging Procedure

Wells will be purged in accordance with procedures outlined in the Site Assessment and Mitigation (SAM) Manual [Department of Environmental Health (DEH), 2005]. For all wells, the low-flow purging and sampling method will be implemented as described in Section 6.1.3. Discharge water, generated during purging and sampling, will be contained in 55-gallon drums or temporarily contained in a plastic tank of approximately 300-gallon capacity, then transferred to a mobile tank prior to transport to the disposal facility.

6.1.3 Low-flow Purging and Sampling Method

The following procedures will be used to purge and sample wells:

1. Sampling personnel will don a new pair of disposable nitrile gloves immediately before purging each well.
2. The decontaminated pump (bladder or submersible) attached to new or decontaminated Teflon[®] tubing will be lowered and set in the middle of the well screen. To minimize disturbance of the groundwater flow conditions, the pump must be placed carefully into the well and lowered into the screen zone as slowly as possible.
3. The decontaminated water level probe will be lowered into the well to monitor water level drawdown during purging.
4. Once the pump and the probe have been lowered into place, then purging will begin. The flow rate must not exceed 1 liter per minute (or 0.26 gallons per minute), with an overall goal of less than 0.1 meter (0.33 feet) of drawdown and a stabilization of the water level in the well. The flow rate will be measured using a graduated cylinder or equivalent.
5. During purging, pH, temperature, conductivity, and turbidity will be measured using flow through a cell and a calibrated water quality meter, and recorded on the Low-flow Purging and Sampling Data Sheet a minimum of three times. The parameters will be measured and recorded every 3 to 5 minutes until parameters have stabilized.
6. Continuous monitoring of water quality indicator parameters is used to determine when purging is completed and sampling should begin. Sampling will commence when water quality indicators are stabilized during three consecutive readings every 3 to 5 minutes. See Section 6.1.4 below for stability criteria for each water quality parameter.
7. After the groundwater parameters have stabilized, groundwater samples will be collected from the pump discharge. If necessary, the flow rate will be decreased to minimize spilling and minimize turbulent flow during sample collection. At no time shall the sampling flow rate exceed the purging flow rate.
8. Groundwater samples will be collected in the following order: volatile analyses and semivolatile analyses. Sample container and preservation requirements specified in the SAP must be followed. Every attempt must be made to collect VOC samples at the lowest rate feasible.
9. Once established, the flow rate should be reproduced with each subsequent sampling event. If a significant change in initial water level occurs between events, it may be necessary to re-establish the optimum flow rate at each sampling event.
10. Sampling personnel will don a new pair of disposable nitrile gloves prior to sampling.
11. Samples will be transferred from the discharge hose of the pump to sample containers. The flow rate will be reduced for VOC sampling. Care will be taken to avoid agitating the sample to minimize loss of VOCs. VOA containers will be filled first as described in Section 6.1.3.1.

containers. Care will be taken to avoid agitating the sample to minimize loss of VOCs. VOA containers will be filled first as described in Section 6.1.3.1.

12. Samples will be collected in pre-preserved, pre-cleaned sample containers. Sample containers will be labeled and stored in resealable bags, and placed in a cooler with ice as described in Sections 6.5 and 6.7.
13. The sample number, date, time, and description of the sample will be recorded on the chain-of-custody (COC) record and in the field logbook. All entries will be written in indelible black or blue ink.
14. The equipment is then removed from the well. All non-disposable sampling equipment will be decontaminated prior to sampling at the next well according to the procedure described in Section 6.3.
15. **Note:** When using this procedure, it is crucial to collect the groundwater samples using the same pump or device used for low-flow purging without moving it or causing disturbance to the well.

6.1.3.1 Volatile Organic Analysis Sampling

VOA samples require a special collection technique. Field sampling will be planned ahead and conducted in consideration of the following conditions:

- Field sampling must be performed in a manner that aeration or mixing of the sample material is avoided.
- Handling and storage of samples must ensure that exposure of the sample to elevated temperatures at any point during the sample collection is avoided.
- Exposure of the collected sample to air must be minimized.

Steps for the water sample collection for VOCs will be as follows:

1. The water samples will be collected into three 40-mL VOA vials carefully to minimize aeration.
2. The vial will be filled up to the lid until a positive meniscus is formed.
3. The vial will be capped immediately, but slowly.
4. The sample will be checked for the presence of air bubbles.
5. If an air bubble is present, the collected sample will be discarded and resampled using a new vial.
6. The previous steps will be repeated until an air-bubble-free sample is collected.

6.1.4 Field Measurement Procedures

Field water quality measurements will be made on groundwater samples during purging using a Horiba® U-22 water quality meter or equivalent instrumentation. During the low-flow purging and sampling method, the water quality meter will be equipped with a flow-through cell. The meter will be used to measure pH, temperature, conductivity, and turbidity of purge water.

Instrument calibration and analysis procedures will follow the instrument manufacturer's instruction manual. Sample measurement will be done after the instrument has been successfully calibrated. A minimum of three readings will be collected during the purging of the well. Stabilization criteria used in the low-flow purging and sampling method are included below.

Groundwater samples may also be monitored for oxidation/reduction potential (ORP) and dissolved oxygen (DO) using field instruments.

6.1.4.1 pH

The pH will be measured using the water quality meter. The meter will be calibrated daily before use according to the instrument manufacturer's instruction manual. Results will be recorded within 0.1 pH unit precision. The pH will be considered stabilized during low-flow purging when readings are measured within ± 0.2 units.

6.1.4.2 Temperature

Temperature of groundwater will be measured using the water quality meter. The instrument manufacturer's instruction manual will be followed for meter calibration. Measurement of the field samples will proceed after calibration is finished. Results will be recorded to the nearest 0.1 degree Celsius ($^{\circ}\text{C}$). The temperature will be considered stabilized during low-flow purging when readings are measured within ± 3 percent of previous reading.

6.1.4.3 Conductivity

The water quality meter will be calibrated for conductivity daily before use according to the instrument manufacturer's instruction manual. Results will be recorded to the nearest 0.1 micromhos per centimeter or microsiemens per centimeter. The conductivity will be considered stabilized during low-flow purging when readings are measured within ± 5 percent of previous reading.

6.1.4.4 Turbidity

Turbidity will be measured using the water quality meter. Instrument calibration and sample measurement procedures will follow the manufacturer's instruction manual. Results will be recorded in nephelometric turbidity units. The turbidity will be considered stabilized during low-flow purging when readings are measured within ± 10 percent of the previous reading.

6.1.4.5 Oxidation/Reduction Potential

Prior to the day's sampling, the performance of the probe will be verified in accordance with the procedures outlined by the manufacturer. There is no calibration procedure for an ORP probe. The verification procedure involves immersing the probe in a standard solution to obtain a reference (E_{ref}) reading (in millivolts) that confirms that the probe is functioning properly. The

field measurements (E_{meas}) taken with the ORP probe are added to the reference value. The ORP, or “ E_h ” value, is calculated by the following formula:

$$E_h = E_{\text{meas}} + E_{\text{ref}}$$

At the end of the day, the ORP probe verification procedure will be repeated to ensure proper functioning of the instrument during sampling. The ORP will be considered stabilized during low-flow purging when readings are measured within ± 20 millivolts.

6.1.4.6 Dissolved Oxygen

The DO instrument will be calibrated each day, using a two-point calibration, in accordance with the procedures provided by the manufacturer. An oxygen-saturated solution will be generated by introducing air into deionized water in a container by bubbling with a small air pump or by agitating vigorously for 2 to 4 minutes. This will yield an oxygen concentration up to approximately 8 milligrams per liter (mg/L) and will serve as a temperature-corrected high-DO verification standard. A table of oxygen-saturation values in water at various temperatures is included in the instrument manual and will be used to define the temperature-corrected DO-saturation value for the calibration. A low verification standard will consist of approximately 300 mL of deionized water into which an excess of sodium bi-sulfate (NaHSO_4) has been added. NaHSO_4 will remove virtually all of the oxygen present in the water, yielding an effective concentration of zero mg/L for the zero-point calibration. To account for uncertainties and variables in DO data collection, all results will be reported with a \pm factor of up to 15 percent, as a guideline for data interpretation. At the end of the day, the calibration verification procedure will be repeated to ensure proper functioning of the instrument during sampling. The DO will be considered stabilized during low-flow purging when readings are measured within ± 0.2 mg/L.

DO readings will be carried out either *in situ* by immersing the probe into the well, or *ex situ* by immersing the probe into samples immediately upon collection. If the *ex situ* method is used, care will be taken to minimize sample agitation during collection.

6.1.5 Instrument Corrective Action Procedure

Appropriate corrective actions must be taken when the calibration of a field instrument fails the instrument-specific calibration QC criteria. The following steps will be followed:

1. Check the instrument.
2. Investigate the cause of failure.
3. Recalibrate the instrument.
4. If the instrument recalibration fails, call the instrument manufacturer for assistance.
5. If the problem persists, send the instrument for service.

6. If a rental instrument is used, contact the rental office for immediate replacement of the instrument.
7. If possible, keep a backup instrument on site.

6.2 WASTE CHARACTERIZATION SAMPLING

Drums of purge water and decontamination water may be generated during field activities. The analytical results from this and previous site assessment activities will be used to characterize soil cuttings and water. Additional samples will not be collected for waste characterization, unless required by the disposal facility. Waste characterization sampling procedures are discussed in the following subsections.

6.2.1 Waste Characterization Sampling Procedures

Waste contained in drums will be sampled for characterization as follows:

1. Sampling personnel will put on a new pair of disposable nitrile gloves immediately before collecting samples at each drum.
2. One sample per every drum will be collected for each type of waste. If the waste is liquid and stored in a tank, one sample will be collected from the tank.
3. The bung top of the drum or other approved container will be carefully opened and a measurement of the atmosphere inside will be taken using a photoionization detector (PID).
4. If the PID reads zero, proceed with completely opening the drum or container. If there are indications that VOCs exist inside, the project health and safety person should be contacted for directions.
5. Liquid samples will be collected using disposable Teflon bailers. Samples will be transferred from the bailers to pre-preserved, pre-cleaned sample containers using a bottom-emptying device. Vials for VOC analysis will be filled according to Section 6.1.3.1.
6. Sample containers will be labeled, stored in resealable bags, and placed in a cooler with ice as described in Sections 6.5 and 6.7.
7. The sample number, date, time, and description of the sample will be recorded on the COC record and in the field logbook. All entries will be written in indelible black or blue ink.
8. All non-disposable sampling equipment will be decontaminated prior to each use as described in Section 6.3.

6.3 DECONTAMINATION PROCEDURES

Decontamination of non-disposable sampling equipment will be performed prior to sampling and in between sample locations to prevent the introduction of extraneous material into samples and to prevent cross-contamination between samples. All sampling equipment will be decontaminated by steam cleaning or by washing with a nonphosphate detergent, such as Liquinox™, or equivalent. Decontamination water will be collected in 55-gallon Department of Transportation (DOT)-approved drums or a poly-tank.

The following procedures will be used for decontamination of non-disposable sampling equipment:

1. **Wash with nonphosphate detergent and water solution**—This step will remove all visible contamination from the equipment. A suitable-size bucket filled with cleaning solution and a long-handled brush is suggested for this step. Dilute nonphosphate detergent as directed by the manufacturer.
2. **Rinse with potable water**—This step will rinse all the detergent solution away from equipment. A suitable-size bucket filled with water and a long-handled brush is suggested for this step. Periodic changing of this water is required. Perform this rinse twice.
3. **Rinse with deionized water**—This step will include double-rinsing to remove detergent solution and potable water residues. Rinsing is most effective when water is applied using a stainless steel Hudson-type sprayer or Nalgene® squeeze bottle while holding equipment over a suitable-size bucket.

If equipment rinsate samples are to be collected, laboratory reagent-grade water will be used as an additional rinse after Step 3. Water that is falling off the sampling equipment (bailer and so forth) as it is being rinsed will be collected in appropriate sample bottles and analyzed for the same parameters as the field samples.

6.4 SAMPLE NUMBER

Samples will be uniquely designated using a numbering system that identifies the Contract Task Order (CTO) number, the site number, and a sequential number (i.e., 003-1106-001).

The sample number will be recorded in the field logbook, on the labels, and COC record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification number.

6.5 SAMPLE LABELING

Sample labels will be filled out in indelible black or blue ink and affixed to sample containers at the time of sample collection. Each sample label will be covered with clear tape. Each sample container will be labeled with the following, at a minimum:

- Sample identification number
- Sample collection date (month/day/year)
- Time of collection (24-hour clock)
- Sampler's initials
- Analyses required
- Preservative (if any)

6.6 SAMPLE CUSTODY

An overriding consideration for data resulting from laboratory analyses is the ability to demonstrate that the data are legally defensible, i.e., that the samples were obtained from the locations stated and that they reached the laboratory without alteration. To accomplish this, evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal will be documented through the COC record.

A sample is considered to be in custody if the following conditions have been observed:

- In actual possession or in view of the person who collected the samples
- Locked in a secure area
- Placed in an area restricted to authorized personnel
- Placed in a container and secured with an official seal, such that the sample cannot be reached without breaking the seal

The COC record lists each sample and the individuals performing the sample collection, shipment, and receipt.

Sample custody will be the responsibility of a SES-TECH on-site designee from the time of sample collection until the samples are accepted by a courier service for delivery to an off-site laboratory. Thereafter, the laboratory performing the analysis will maintain custody.

The COC record will be the controlling document to ensure that sample custody is maintained. Sampling personnel upon collecting a sample will initiate the COC record in the field.

Each time the sample custody is transferred, the former custodian will sign the COC on the "Relinquished By" line, and the new custodian will sign the COC on the "Received By" line. The date, time, and the name of their project or company affiliation will accompany each signature.

The waybill number or courier name will be recorded on the COC when a commercial carrier is used. The shipping container will be secured with two custody seals, thereby allowing for custody to be maintained by the shipping personnel until receipt of the laboratory.

In addition to providing a custody exchange record for the samples, the COC record serves as a formal request for sample analyses. The COC records will be completed, signed, and distributed as follows:

- The original (and a copy) sent to the analytical laboratory with the sample shipment
- One copy retained on site for inclusion in the project files
- One copy sent to the SES-TECH Project Chemist

At a minimum, the following items will be recorded on the COC record:

- Project name
- Project location/Site ID
- Project number
- Purchase order number
- Sample ID
- Sampler name
- Sampler signature
- Project contact
- Airbill number (if applicable)
- Date (of sample collection)
- Time (of sample collection to the nearest minute, 24-hour clock)
- Sample type (matrix)
- Turnaround time
- Sample location codes:

Examples:

water samples: *Site name-MW#*
equipment rinsate: *Site name-EQ RINSATE*
drum samples: *Site name-D1*

- Sample depth in feet (start, end)
- QC type:

REG: regular sample
TB: trip blank
FD: field duplicate
ER: equipment rinsate
SMQC: source blank

- Composite description (if applicable)
- Laboratory name
- Number of sample containers
- Laboratory ID
- Analyses required
- Comments
 - Matrix spike/matrix spike duplicate (MS/MSD) samples
 - Observations specific to sample
 - Electronic data format (EDF), if required
- Transfer signature (to relinquish samples)
 - The sampler will be the first person to relinquish sample possession
- Courier/laboratory representative signature (for commercial carrier, record airbill number here)
- Date/time (of custody transfer)
- Laboratory instructions
- Data package requirement (Level III or IV)

6.7 SAMPLE PACKAGING AND SHIPMENT

Immediately after sample labeling, custody seals will be affixed to each sample container. For VOA vials, the custody seal will be placed on the outside of the first resealable bag; then the container will be placed in a second resealable bag. This will prevent any contact with the adhesive from the custody seal and the sample. Other sample containers will be placed in double-resealable plastic bags to protect the sample from moisture and to prevent breakage and potential cross-contamination during transportation to the laboratory. All glass sample containers will be protected with bubble wrap first if transported by a commercial carrier. VOA vials should be wrapped with bubble wrap, then placed in a resealable bag, a custody seal placed over the bag, and then placed in another resealable bag.

Each cooler will be shipped with a temperature blank. A temperature blank is a vial filled with tap water and stored in the cooler during sample collection and transportation. The temperature of the cooler will be recorded by the laboratory on the COC record immediately upon receipt of the samples.

Sample cooler drain spouts will be taped from the inside and outside of the cooler to prevent any leakage.

Samples transported by a laboratory-assigned courier will be packed in a sample cooler with sufficient ice to keep the samples cooled. Two custody seals will be taped across the cooler lid:

one seal in the front and one seal in the back. The COC record will be completed and signed by the courier. The cooler and the top two copies (white and pink) of the COC record will then be released to the courier for transportation to the laboratory.

Samples to be shipped by commercial carrier will be packed in a sample cooler lined with a plastic bag. Double-bagged ice will be added inside the plastic bag at the bottom of the cooler, one layer of sample containers will be placed on the ice, and more double-bagged ice will be placed on top of the containers. This will be repeated until the cooler is filled with ice as the top layer in the cooler. The COC record will include the airbill number, and the “Received By” box will be labeled with the commercial courier’s name. The top two copies of the COC record will be sealed in a double-resealable bag and then taped to the inside of the sample cooler lid. The cooler will be taped shut with strapping tape. Two custody seals will be taped across the cooler lid: one seal in the front and one seal in the back. Clear tape will be applied to the custody seals to prevent accidental breakage during shipment. The pouch for the airbill will be placed on the cooler and secured with clear tape. The airbill will be completed for priority overnight delivery and placed in the pouch. If multiple coolers are being shipped, then the original airbill will be placed on the cooler with the COC record, and copies of the airbill will be placed on the other coolers. The number of packages should be included on each airbill (1 of 2, 2 of 2). Saturday deliveries should be coordinated with the laboratory in advance, and field sampling personnel or their designee must ensure that Saturday delivery stickers are placed on each cooler by the commercial courier. “Dangerous goods” declarations will also be completed as applicable.

6.8 FIELD DOCUMENTATION AND RECORDS

In order to maintain the integrity and traceability of samples, all information pertinent to field sampling will be recorded in a field logbook. All samples will be properly labeled and custody-sealed prior to being transported to the laboratory and will be accompanied by completed COC documentation. All documentation will be recorded in indelible black or blue ink.

6.8.1 Chain-of-Custody

To establish the documentation necessary to trace sample possession from the time of collection through analysis and disposal, a COC record will be completely filled out and will accompany every sample. Samples will be delivered to the laboratory for analysis as soon as practicable. A COC record will accompany all samples. The COC record will be completed as described in Section 6.6.

6.8.2 Custody Seals

Sample custody seals are used to detect unauthorized tampering of samples from the time of sample collection to the time of analysis. The seals will be signed or initialed and dated by the sampler. The seals will be placed on the sample containers and shipping containers in such a way

that they must be broken in order to open the containers. Seals will be affixed to containers before the samples leave the custody of the sampling personnel.

6.8.3 Field Logbooks

A permanently bound field logbook with consecutively numbered pages, used for sampling activities only, will be assigned to this project. All entries will be recorded in indelible black or blue ink. At the end of each workday, the logbook pages will be signed by the responsible sampler and any unused portions of the logbook pages will be crossed out, signed, and dated.

If it is necessary to transfer the logbook to another person, the person relinquishing the logbook will sign and date the last page used and the person receiving the logbook will sign and date the next page to be used.

At a minimum, the logbook will contain the following information:

- Project name and site location
- Date and time
- Personnel in attendance
- General weather information
- Work performed
- Field observations
- Sampling performed, including specifics such as location, type of sample, type of analyses, and sample identification
- Field analyses performed, including results, instrument checks, problems, and calibration records for field instruments
- Descriptions of deviations from the CDQMP or this SAP
- Problems encountered and corrective action taken
- Identification of field QC samples
- QC activities
- Verbal or written instructions
- Any other events that may affect the samples

6.8.4 Document Corrections

Changes or corrections on any project documentation will be made by crossing out the erroneous item with a single line, initialing by the person performing the correction, and dating the correction. The original item, although erroneous, must remain legible beneath the cross-out line. The new information should be written clearly above the crossed-out item. Corrections will be written clearly and legibly with indelible black or blue ink.

7.0 PROJECT ORGANIZATION

This section identifies the key individuals from DON and SES-TECH who are responsible for the oversight and/or implementation of the proposed field activities. The project organization chart is shown in Figure A.7-1. The responsibilities of the team members associated with the sampling activities are presented in Table A.7-1.

7.1 LIST OF POINTS OF CONTACT

The following is a list of the key contacts for the project:

Agency	Contact	Title
NFECSW 1220 Pacific Highway San Diego, CA 92132-5190	Mr. Bipin Patel (619) 532-4814	Remedial Project Manager
NFECSW 1220 Pacific Highway San Diego, CA 92132-5190	Mr. Narciso Ancog (619) 532-3046	QA Officer
MCB Camp Pendleton ROICC Office Building 22101 Camp Pendleton, CA 92055-5229	Mr. Yusuf Abdul-Rashad (760) 725-3399	Naval Technical Representative/ Resident Officer in Charge of Construction (ROICC)
SES-TECH 18000 International Boulevard, Suite 1009 Seattle, WA 98188	Mr. Mark Cutler (949) 756-7526	Project Manager
SES-TECH 18000 International Boulevard, Suite 1009 Seattle, WA 98188	Ms. Lisa Bienkowski (949) 756-7592	Program Chemist
SES-TECH 18000 International Boulevard, Suite 1009 Seattle, WA 98188	Ms. Mary Schneider (949) 756-7586	QC Program Manager
SES-TECH 18000 International Boulevard, Suite 1009 Seattle, WA 98188	Ms. Sevda Aleckson (949) 756-7549	Project Chemist

8.0 QUALITY ASSURANCE OBJECTIVES

Managing the quality of data requires that objectives be established for the data as a basis against which the quality can be assessed. This section describes the DQO process, analytical DQOs and indicators, and analytical method requirements.

8.1 DATA QUALITY OBJECTIVES

The DQOs specify the project objectives, the data collection boundaries and limitations, the most appropriate type of data to collect, and the level of decision error that will be acceptable for the decision. The quality and quantity of data required to implement environmental remedial action are also defined. The scope, level of detail, and verification for the design and planning documents may vary from project to project, depending on the project-specific conditions and the nature and complexity of the proposed activities. The project-specific DQOs, as defined through the seven-step process (EPA, 2000), are as follows:

1. State the problem.
2. Identify the decision.
3. Identify inputs to the decisions.
4. Define the boundaries.
5. Develop a decision rule.
6. Specify the limits on decisions errors.
7. Optimize the sampling design.

The DQOs are presented in Table A.8-1.

8.2 ANALYTICAL DATA QUALITY OBJECTIVES

A laboratory with appropriate capabilities and accreditation will produce analytical data required for the project using approved methods of analysis. This section describes laboratory qualification, sample custody and documentation, QC procedures, QC samples, and preventative maintenance for the laboratories.

8.2.1 Laboratory Qualifications

The off-site laboratory that will provide analytical services for this project will be State of California Department of Health Services (DHS) Environmental Laboratory Accreditation Program (ELAP)-certified analytical laboratories. All off-site environmental analytical laboratories would have successfully completed the Naval Facilities Engineering Service Center (NFESC) Laboratory Evaluation Program. Any deviations from these requirements will require

approval of the QA Officer. QA personnel for the laboratory will be designated in each laboratory's QA Manual. The analytical laboratory will designate a Project Manager for this project.

Laboratories selected for the project must be capable of providing the project QC samples and data deliverables required by this SAP.

8.2.2 Laboratory Sample Custody and Documentation

The integrity and traceability of samples from the time they are collected through the time data are reported are essential in any sampling and analysis program. The handling of the samples and transferring of custody must be well-documented given the evidentiary nature of the analytical data. A sample is considered to be in one's custody if it meets any of the following criteria listed in Section 6.6.

The samples will be delivered to the person in the laboratory authorized to receive samples (referred to as the sample custodian). Upon receipt of a sample, the sample custodian will inspect the condition of the sample (including the temperature of the cooler as applicable) and the custody seal, reconcile the information on the sample label against that on the COC record, assign a unique laboratory tracking number, log the sample in the laboratory logbook, and store the sample in a secured sample storage room.

If the laboratory sample custodian judges sample custody to be invalid (for example, custody seals have been broken), the laboratory will initiate a Nonconformance Report (NCR). SES-TECH personnel will be immediately notified of this event. SES-TECH will make a decision, in consultation with the client, as to the fate of the sample(s) in question on a case-by-case basis. The sample(s) will either be processed "as is" with custody failure noted along with the analytical data, or rejected with resampling scheduled, if necessary. The nonconformance associated with the samples will be noted on the appropriate certificate or analysis or case history.

The laboratory will initiate an internal COC that will track the sample within the various areas of the laboratory. The relinquishing signature of the sample custodian and the custody acceptance signature of the laboratory personnel transfer custody of the sample. This procedure is followed each time a sample changes hands. The laboratory will archive the samples and maintain their custody as required by the contract or until further notification from SES-TECH, at which time, the samples will either be returned to the project for disposal or disposed of by the laboratory.

8.2.3 Laboratory Quality Control Procedures

The analytical laboratory will have written standard operating procedures (SOPs) defining the instrument operation and maintenance, tuning, calibration, method detection limit (MDL) determination, QC acceptance criteria, blank requirements, and stepwise procedures for each

analytical method. At a minimum, SOPs will be written for the following procedures and methods: sample receipt/control/disposal, sample preparation/extraction, sample analysis, result calculation, database management, health and safety, and corrective action. The SOPs and all revisions will be available to the analysts in the laboratory. The SOPs must meet or exceed the requirements of the analytical methods and the *Quality Systems Manual for Environmental Laboratories* [Department of Defense (DoD), 2000]. The laboratory must maintain logs of all activities that have an impact on the quality of the laboratory results.

Any portion of the method that is subcontracted by the laboratory to another laboratory or sent to another facility of the same network of laboratories must have the prior approval of the SES-TECH Project Chemist.

The laboratory must maintain the instruments in working condition required by the methods specified for the analyses. Sufficient redundancy in equipment must be available in the laboratory to handle downtime situations. Method substitution because of instrumental failure will not be permitted without approval from the SES-TECH Project Chemist.

8.2.4 Laboratory Quality Control Checks

The following subsections describe in detail the laboratory QC checks required by this project.

8.2.4.1 Calibration

All instruments will be calibrated and the calibration acceptance criteria met before samples are analyzed. Calibration standards will be prepared with National Institute for Standards and Testing (NIST)-traceable standards and analyzed per method requirements. Initial calibration (ICAL) acceptance criteria documented in the laboratory SOPs will meet those of applicable guidance documents. The ICAL will meet the following requirements:

- The lowest concentration of the calibration standard is less than or equal to the RL based on the final volume of extract or sample.
- For each target analyte, at least one of the calibration standards will be at or below the regulatory limit (action level) as defined by the DQOs.
- Before samples are analyzed, ICAL will be verified with a second source standard prepared at the mid-point of the calibration curve. ICAL verification will meet the acceptance criteria, which are expressed in the laboratory SOPs.
- Daily calibration verification will be conducted at the method-prescribed frequencies, and will meet the acceptance criteria of applicable guidance documents. Daily calibration verification will not be used for quantitation of target analytes.
- Calibration data (calibration tables, chromatograms, instrument printouts, and laboratory logbooks) will be clearly labeled to identify the source and preparation of the calibration standard and therefore, be traceable to the standard preparation records.

8.2.4.2 Instrument Blanks

An instrument blank is used to monitor the cleanliness of the instrument system during sample analysis. Instrument blanks are solvent or acid solutions of the standard used to calibrate the instrument. During metals analyses, one instrument blank is usually analyzed for every ten samples. For gas chromatograph (GC)/mass spectrometer (MS) analysis, instrument blanks are analyzed on an as-needed basis for troubleshooting and chromatography column carryover determination.

8.2.4.3 Method Blanks

Method blanks are prepared in the same manner as the samples, using the same reagents and glassware used for samples. The purpose of the method blank is to ensure that the equipment and reagents used in preparing the samples are free of contaminants that could interfere with the analysis. The method blank must be prepared and analyzed for each batch of 20 project samples or less per matrix (aqueous and solid) type.

The method blank must not exhibit analytes at concentrations greater than half the required RLs. If contaminants are found that either contribute to the apparent concentration of a particular target analyte or interfere with the analysis, the analysis must be stopped, the source of contamination identified and corrected, and the analysis repeated. Contamination in the method blank above half the RLs will require that the entire associated batch of extracts or digestates be reprepared and reanalyzed. Hence, it is very important to make sure that no such contamination is present.

Some methods of inorganic analysis do not have a distinctive preparation step. For these tests, an instrument blank, which contains all reagents used with samples, is considered to be the method blank.

8.2.4.4 Laboratory Control Samples

Laboratory control samples (LCSs) are matrix-equivalent QC check samples (analyte-free water, laboratory sand, or sodium sulfate) spiked with a known quantity of specific analytes that are carried through the entire sample preparation and analysis process. The spiking solution used for LCSs/laboratory control sample duplicates (LCSDs) preparation is of a source different from the stock that was used to prepare calibration standards.

The LCS is prepared and run at a frequency of one per 20 project samples per matrix with the associated samples, using the same reagents and volumes. If insufficient quantity of sample is available for the MS/MSD, the LCS will be prepared and analyzed in duplicates.

8.2.4.5 Laboratory Duplicates

For laboratory sample duplicate analyses, a sample is prepared and analyzed twice. Laboratory sample duplicates are prepared and analyzed with each batch of samples for most inorganic analyses.

8.2.4.6 Matrix Spikes

MSs are QC check samples that measure matrix-specific method performance. MSs are only applicable to the off-site laboratory. A MS sample is prepared by adding a known quantity of target analytes to a sample prior to sample digestion or extraction. In general, for organic compound and metal analyses, an MS/MSD pair is prepared and analyzed with each preparation batch or for every 20 samples. For inorganic compound analysis, a single MS and a laboratory sample duplicate are often prepared and analyzed with each batch. The MS results allow verifying the presence of matrix effects.

8.2.4.7 Surrogate Standards

Organic compound analyses include the addition, quantitation, and recovery calculation of surrogate standards. Compounds selected to serve as surrogate standards must meet all of the following requirements:

- Are not the target analytes
- Do not interfere with the determination of target analytes
- Are not naturally occurring, yet are chemically similar to the target analytes
- Are compounds exhibiting similar response to target analytes

Surrogate standards are added to every analytical and QC check sample at the beginning of the sample preparation. The surrogate standard recovery is used to monitor matrix effects and losses during sample preparation. Surrogate standard control criteria are applied to all analytical and QC check samples, and if surrogate criteria are not met, re-extraction and reanalysis may be performed.

8.2.4.8 Internal Standards

Some organic compound analyses include the addition, quantitation, and recovery calculation of internal standards. Internal standards are usually synthetic compounds, which are similar in chemical behavior to the target analytes. They are added to sample extracts at the time of instrument analysis, and are used to quantify results through internal standards calibration procedures. Internal standard recoveries are used to correct for injection and detector variability. GC/MS must use internal standards and have specific acceptability limits for internal standard areas. Use of internal standard quantitation for GC methods is optional.

8.2.4.9 Post-digestion Spikes and the Method of Standard Addition

A post-digestion spike is used during metal analysis to assess analytical interferences that may be caused by general matrix effects or high concentrations of analytes present in the sample. A digested sample is spiked with the analyte of interest at a known concentration, and the spike recovery is used to estimate the presence and the magnitude of interferences.

If a post-digestion spike recovery fails to meet acceptance criteria, the Method of Standard Addition (MSA) will be used to quantify the sample result. The MSA technique compensates for a sample constituent that enhances or depresses the analyte signal. To perform the MSA, known amounts of a standard at different concentrations are added to aliquots of digested sample, and each spiked sample and the original unspiked sample are analyzed. The absorbance is then plotted against the concentration, and the resulting line is extrapolated to zero absorbance. The point of interception with the concentration axis is the indigenous concentration of the analyte in the sample.

8.2.4.10 Preventative Maintenance

All instruments must be maintained in accordance with the manufacturers' recommended procedures. The laboratory must define in its QA plan the frequency and type of maintenance for each instrument. The laboratory must also record all maintenance activities in an instrument logbook.

In addition to preventive maintenance, the laboratory must keep a sufficient supply of replacement parts on hand for those parts known to require frequent changes due to wear and tear or contamination.

Whenever preventive or corrective maintenance is applied to an instrument, the laboratory must demonstrate the instrument's return to operating conditions and must recalibrate the instrument prior to resumption of sample analyses.

8.3 DATA QUALITY INDICATORS

Analytical DQOs will be assessed through application of precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters discussed in this section.

8.3.1 Precision

Precision is the measure of the reproducibility of a set of replicate results or the agreement among repeat observations made under the same conditions. Analytical precision is the measurement of the variability associated with duplicate or replicate analyses. For a project, a LCS will be used to determine the precision of the analytical method. Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate field samples and measures variability introduced by both

the laboratory and field operations. Field duplicate, laboratory duplicate, and MSD samples will be used to assess field and analytical precision, and the precision measurement will be determined using the relative percent difference (RPD) between the duplicate sample results. The formula for calculating the RPD is as follows:

$$RPD = 100 \times 2 \times (\text{result} - \text{duplicate result}) / (\text{result} + \text{duplicate result})$$

The analytical laboratory will have statistically based acceptability limits for RPDs established for each method of analysis and sample matrix. These statistically based acceptability limits are called control limits.

The laboratory will review the QC sample data to ensure that internal QC data lie within the control limits. Control limits are defined as the mean recovery, plus-or-minus three standard deviations, of the 20 data points, with the warning limits set as the mean plus-or-minus two standard deviations. Any suspect trends will be investigated and corrective actions taken. The analytical precision acceptability limits for a project will be as follows:

LCS/LCD

Water: 20 percent for all analyses

MS/MSD

Water: 30 percent for all analysis

Table A.8-3 provides the QC acceptance limits to be followed for this project.

8.3.2 Accuracy

Accuracy is defined as the nearness of a result or the mean of a set of results to the true or accepted value. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into a sample against a control limit. Percent recoveries for MSs, MSDs, and LCSs that are analyzed for every batch of up to 20 samples serve as a measure of analytical accuracy. Surrogate standards are added to all field samples, blanks, MSs, MSDs, and LCSs analyzed for organic contaminants to evaluate the method's accuracy and help to determine matrix interferences. The formula for calculating accuracy uses the following equation to determine percent recovery (%R) of specific analytes.

$$\%R = 100 \times (\text{spiked sample result} - \text{unspiked sample result}) / \text{amount of spike added}$$

The spiking solutions used for accuracy determinations are not used for instrument calibrations.

As a general rule, the recovery of most compounds spiked into samples is expected to fall within a range of 70 to 130 percent. This range represents the EPA advisory acceptability limits for MSs, MSDs, and LCSs for all organic analysis methods. The surrogate standard advisory

acceptability limits are also 70 to 130 percent for all organic analyses with the exception of GC/MS methods, where these limits are specified in the methods for each matrix. EPA SW-846 mandates the recovery acceptance limits for metal analysis at 75 to 125 percent. Table A.8-3 provides the QC acceptance limits to be followed for this project.

The laboratory will review the QC samples and surrogate standard recoveries for each analysis to ensure that internal QC data lie within the control limits of acceptability. The laboratory will investigate any suspect trends and take appropriate corrective actions according to internal laboratory procedures.

8.3.3 Representativeness

Unlike precision and accuracy, which can be expressed in quantitative terms, representativeness is a qualitative parameter. Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. It is a qualitative parameter that depends on proper design of the sampling program.

Field personnel will be responsible for ensuring that samples are representative of field conditions by collecting and handling samples according to the approved CDQMP and this SAP. Errors in sample collection, packaging, preservation, or COC procedures may result in samples being judged non-representative and may form a basis for rejecting the data.

Data generated by the laboratory must be representative of the laboratory database of accuracy and precision measurements for analytes in different matrices. Laboratory procedures for sample preparation will ensure that aliquots used for analysis are representative of the whole sample. Aliquots to be analyzed for volatile parameters will be removed before the laboratory composites/homogenizes the samples, to avoid losing volatile compounds during mixing.

8.3.4 Completeness

Completeness is the percentage of measurements made that is judged to be valid. The completeness goal is to generate a sufficient amount of valid data to meet project needs. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with a rejected ("R") flag. The requirement of completeness is 90 percent for gas samples, 95 percent for aqueous samples, and 90 percent for soil samples and is determined using the following equation:

$$\% \text{ completeness} = 100 \times (\text{number of valid analyte results} / \text{number of possible results})$$

8.3.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another, whether it was generated by a single laboratory or during inter-laboratory studies. The use of standardized field and analytical procedures ensures comparability of analytical data.

Sample collection and handling procedures will adhere to EPA-approved protocols. Laboratory procedures will follow standard analytical protocols, use standard units, standardized report formats, follow the calculations as referenced in approved analytical methods, and use a standard statistical approach for QC measurements.

8.4 PROPOSED REPORTING LIMITS

The laboratory will determine the MDLs for each method, instrument, analyte and matrix by using the procedure described in 40 Code of Federal Regulations (CFR) Part 136, Appendix B. The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero.

An MDL study involves preparation/digestion and analysis of seven replicates of a given matrix spiked with target analytes at concentrations two to five times greater than the estimated MDL. At a minimum, the laboratory will conduct annual MDL studies.

Proposed RLs for this project are presented in Table A.8-2. These limits may be elevated for individual samples if matrix interferences are encountered, or may be altered based on analytical laboratory capabilities.

9.0 DATA MANAGEMENT

9.1 LABORATORY DATA REVIEW

All data reported by the laboratory must be reviewed in accordance with the SOPs and as described in the following subsections.

9.1.1 Analyst Review

Each analyst that generates a data set is responsible for ensuring that 100 percent of the data comply with the method- and project-specific requirements and that any deviations or failure to meet criteria are documented for the project file.

9.1.2 Peer Review

One hundred percent of all data sets must be reviewed by an independent peer analyst. Peer reviews must be performed by an analyst that is qualified to perform the subject analytical method. The peer review must be comprehensive and include the following:

- Check 100 percent of manual entries for transcription errors
- Check 100 percent of manual calculations for accuracy
- Spot-check computer calculations to verify program validity
- Check for compliance with method- and project-specific QC requirements
- Check for completeness of raw data or supporting materials
- Confirm spectral assignments
- Check descriptions of deviations from method or project requirements
- Check for appropriate use of significant figures and rounding
- Check reported values for dilutions
- Evaluate reasonableness of results

9.1.3 Technical Review

Technical reviews by the responsible supervisor or designated alternate must be performed on 100 percent of reported data. The same individual may not perform peer and technical reviews on the same data set. The technical review must include the following:

- Check for compliance with method- and project-specific requirements
- Check the completeness of the reported information
- Check the information in the report narrative
- Evaluate the reasonableness of the results

If the responsible supervisor is the only qualified peer reviewer for a method, the requirement for the technical review is waived.

9.1.4 Management Review

One hundred percent of all data must receive management approval prior to release. The scope and content of management's review is at the laboratory's discretion. Authority to release data may be delegated to a technical supervisor or other party, if the term of the delegated authority is documented in the QA program file.

9.1.5 Quality Assurance Review

QA reviews of data from each section of the laboratory must be conducted on a routine basis. Annually, at least 10 percent of data reports generated using each analytical method must be reviewed by a member of the QA staff. The QA reviews must include the following:

- Check for compliance with required QC practices
- Check for compliance with approved SOPs
- Check for compliance with method and project requirements

QA data reviews may be conducted after the subject data have been reported to SES-TECH.

9.2 LABORATORY DATA DELIVERABLES

The following sections describe the deliverable documents that will be submitted to SES-TECH by the analytical laboratory.

9.2.1 Hard-copy Report

All relevant raw data and documentation, including, but not limited to, logbooks, data sheets, electronic files, and final reports, will be maintained by the laboratory for at least 7 years. SES-TECH will be notified 30 days before disposal of any relevant laboratory records.

SES-TECH will maintain copies of all COC records. Laboratory reports will be logged in upon receipt and filed in chronological order.

Two copies of the hard-copy data will be submitted to SES-TECH by the laboratory. The report pages will be sequentially numbered. The report will contain a table of contents referencing individual sections in the data package, an original copy of COC records, a copy of all corrective action reports, and a narrative documenting the resolution of all corrective actions and nonconformances. All SES-TECH samples will be cross-referenced to the associated QC samples. When revisions to data reports are required, the revised pages will be stamped with the notation "amended or revised report."

For waste characterization samples, 100 percent of the data will be submitted in an EPA Level III-equivalent data package. All data packages will be assembled in the following sequence:

- Cover page (with laboratory service identification number, SES-TECH project name, and SES-TECH project number)
- Original COC records (including cooler temperature and sample condition)
- Sample receipt forms
- Cross-reference table
- Case narrative
- Organic raw data sequence (by test):
 - Sample result forms, including method blanks
 - Sample raw data after each result form (EPA Level IV only)
 - Surrogate summaries (surrogate results may appear on the sample result forms)
 - QC summaries
 - Tune data (GC/MS only)
 - ICAL
 - Daily calibration checks, including related continuing calibration verifications (CCVs)
 - Resolution check standards (GC/MS and pesticides) (if applicable)
 - QC (LCS, MS/MSD) raw data (EPA Level IV only)
 - Instrument run log
 - Sample preparation log

9.2.2 Electronic Data

The electronic data deliverable (EDD) will be in ASCII format. This will be compatible with the Naval Electronic Data Deliverable standard as described in *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards* (NFECSW, 2005). The laboratory will verify that the EDD and the hard-copy reports are identical. Both the EDD and the hard-copy report will present results to two or three significant figures. For organic results, two significant figures will be used for all results. For inorganic results, two significant figures will be used for results less than 10, and three significant figures will be used for results greater than 10. Results for QC analyses (method blanks, MS/MSD, LCS, and duplicates) will be reported up to three significant figures. The EDD for each sample delivery group is due at the same time as the hard-copy report, 21 calendar days after the last sample of the sample delivery group has been delivered to the laboratory.

In addition, the laboratory will submit data in the State Water Resources Control Board UST program "EDF." The laboratory will check all EDFs using the Electronic Data Consistency Checker (EDCC) software, which generates a report summarizing any errors/warnings found in the EDF. The report must be submitted along with the EDF, and must indicate zero errors in order for the EDF to be acceptable. "Warnings" may be acceptable in the report, but must be discussed in the EDCC documentation. If errors exist in the EDF, the laboratory must correct the errors and resubmit the EDF. A complete EDF submission includes a diskette containing the EDF files and a hard-copy EDCC report showing zero errors.

Field information (date and time collected, sample identification, and so forth) will be entered directly into a Microsoft database from the COC records or uploaded from electronic files generated in the field. Upon receipt by the SES-TECH Data Manager, electronic data will be uploaded into the database. The uploaded data will be processed to compare the fields against a list of required values. If any errors are returned by the program, the file will be manually edited or regenerated by the laboratory. The laboratory database will be merged with the field database, and reports will be generated from the merged database.

9.3 DATA VALIDATION

All sample data, with the exception of waste characterization samples, will be validated by an independent data validation company. Data will be validated at 90 percent EPA Level III and 10 percent EPA Level IV. The validation will be in accordance with the *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA 540/R-99-008 (EPA, 1999), *Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation* (NFECSW, 2001a), and the QC criteria specified in the referenced methods and in this SAP. Data not meeting method and/or SAP specifications will be flagged as estimated ("J") or rejected ("R").

The data validation company will have the following qualifications:

1. A minimum of 5 years of experience in the environmental data validation business
2. Prior experience on DON Remedial Action Contract or Comprehensive Long-term Environmental Action projects
3. DON data validation experience
4. Active peer review program

Personnel must have the following qualifications:

1. Data Reviewer:
 - Bachelor of science degree or higher in chemistry or a physical science

- 5 years of combined experience with approximately 2 years in data validation and 3 years conducting laboratory analysis in an environmental laboratory using the EPA-approved methods being validated

2. Peer Reviewer:

- Bachelor of science degree or higher in chemistry or a physical science
- 5 years of combined experience with approximately 2 years in data validation and 3 years conducting laboratory analysis in an environmental laboratory using the EPA-approved methods being validated

9.4 DATA EVALUATION

Following third-party validation, data will be further evaluated by the SES-TECH Project Chemist. During this process, the SES-TECH Project Chemist will determine which of the advisory data qualifiers provided by the independent data validator will be retained or removed. The evaluation of data will be based on method requirements and the results of the QC samples, the level of contamination of samples indicated by the method blanks analysis, and the overall indication of interference due to contamination. The following data qualifiers will be used in the report:

J - Result is estimated

U - Analyte is not detected at or above the stated RL

R - Data are rejected

UJ- Analyte is not detected, but there is an uncertainty about the RL

Data qualifying will be used to alert end users to uncertainties associated with the data. The evaluation flags will be entered into a special field in the electronic database. Thus, when data processing is complete, the data for each analyte will have the flag designated by the laboratory and the flag designated by the evaluator, as appropriate.

10.0 QUALITY ASSURANCE OVERSIGHT

QA oversight for this project will include system audits of field activities and of the laboratory subcontracted by the DON to perform the analysis.

10.1 FIELD AUDITS

The SES-TECH and NFEC SW QA Officers may schedule audits of field activities at any time to evaluate the execution of sample collection, identification, and control in the field. The audit will also include observations of COC procedures, field documentation, instrument calibrations, and field measurements.

Field documents and COC records will be reviewed to ensure that all entries are printed or written in indelible black or blue ink, dated, and signed.

Sampling operations will be reviewed and compared to the CDQMP and this SAP and other applicable SOPs. The auditor will verify that the proper sample containers are used, the preservatives are added or are already present in the container, and the documentation of the sampling operation is adequate.

Field measurements will be reviewed by random spot-checking to determine that the instrument is within calibration, the calibration is done at the appropriate frequency, and that the sensitivity range of the instrument is appropriate for the project.

10.1.1 Corrective Action

Nonconformance identified during the field audit will be recorded on a NCR. All nonconformance and corrective actions will be processed in accordance with procedures in the *Final Contractor Quality Control Program Plan* (SES-TECH, 2005b).

The SES-TECH QC Program Manager will monitor corrective action documentation, verify implementation of the corrective action, track and analyze the corrective action, and close out corrective action documentation upon completion of the corrective action.

10.2 LABORATORY AUDITS

The laboratory selected to perform the analyses is required to have successful completion of the NFESC laboratory evaluation process throughout the project. This process consists of a laboratory QA plan review, performance evaluation samples, a data package review, and an on-site audit. Because of this requirement, SES-TECH will not perform an on-site audit or visit, unless it is deemed necessary.

Laboratory oversight by SES-TECH will include a thorough review of the preliminary report and hard-copy data packages. The information that may be obtained from the data packages consists of the following:

- Correctness of COC procedures
- Adherence to method holding times
- Project RLs
- Spiking levels, frequency, and recovery
- Accuracy of analytical methods through the LCSs and surrogates

10.2.1 Corrective Action

The laboratory will have a QA/QC and corrective action program that addresses all out-of-control situations. Following completion of analyses, laboratory personnel will verify compliance with the minimum QC requirements of the project and the laboratory QA/QC plan. If any of the parameters fall outside the control limits, corrective action will be implemented.

Initial corrective action is to verify that no obvious calculation errors have occurred. If appropriate, reanalysis will be performed. If the reanalysis confirms the initial out-of-control limits result, the chemist will notify the laboratory supervisor, who will initiate the corrective action process. Corrective actions may include, but are not limited to, the following:

- Verification of dilution factors
- Examination of sample for nonhomogeneity
- Verification of sample preparation
- Checking of standard preparation logbook
- Verification of instrument performance
- Checking of reagent-grade water purity
- Monitoring chemist's method performance for procedure verification

Notification and prompt involvement of the SES-TECH Project Chemist in the corrective action process are absolutely necessary in determining an appropriate resolution. Corrective action records will document all steps taken in the corrective action process, beginning with a description of the problem and ending with a final resolution. A copy of the corrective action report will be sent to the SES-TECH Project Chemist immediately and will be maintained in the project files at SES-TECH.

All corrective action reports will be maintained by the laboratory in a project file and delivered to the SES-TECH Project Chemist as part of the hard-copy deliverable.

11.0 SAP REVISION OR AMENDMENT

When circumstances arise that impact the original project DQOs, such as a significant change in work scope, this SAP will be revised or amended. The modification process will be based on EPA guidelines, direction from the DON and QA Officer, and will be in conjunction with *Environmental Work Instruction (EWI) #2, 3EN2.2, Review, Approval, Revision, and Amendment of Sampling and Analysis Plans (SAPs)* (NFECSW, 2001b).

12.0 REFERENCES

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TABLES

TABLE A.5-1**SAMPLE CONTAINERS, PRESERVATIVES,
AND HOLDING TIME REQUIREMENTS**

Analysis	Analytical Method	Container	Preservative	Holding Time
Water				
TPH-d	EPA Method 3520C/8015B	Two 1-L glass ambers	Cool, 4±2°C	7 days to extraction and 40 days to analyze
VOCs	EPA Method 5030B/8260B	Three 40-mL VOA vials	Cool, 4±2°C, pH ≤ 2 w/ HCl	14 days
PAHs	EPA Method 3520C/8270C SIM or 3520C/8310	Two 1-L glass ambers	Cool, 4±2°C	7 days to extraction and 40 days to analyze

Notes:

°C	–	degrees Celsius	PAH	–	polynuclear aromatic hydrocarbon
EPA	–	U.S. Environmental Protection Agency	SIM	–	Selective Ion Monitoring
HCl	–	hydrochloric acid	TPH-d	–	total petroleum hydrocarbons quantified as diesel
L	–	liter	VOA	–	volatile organic analysis
mL	–	milliliter	VOC	–	volatile organic compound

TABLE A.7-1
PERSONNEL AND RESPONSIBILITIES

Key Position	Responsibility
NFECSW QA Officer	<ul style="list-style-type: none"> • Provides governmental oversight of the SES-TECH QA Program • Provides quality-related directives through Contracting Officer Representative • Provides technical and administrative oversight of SES-TECH surveillance audit activities • Acts as point of contact for all matters concerning QA and the DON's Laboratory QA Program • Prepares governmental budget estimates for all QA functions included in SES-TECH contracts • Coordinates training on matters pertaining to generation and maintenance of quality of data • Authorizes the suspension of project execution if QA requirements are not adequately followed
QC Program Manager	<ul style="list-style-type: none"> • Reviews and approves the QCP and following revisions • Periodically evaluates the effectiveness of the QCP through conducting surveillances, audits, or management assessments • Assigns, directs and supports the PQCM and staff • Trains, qualifies, and evaluates the PQCM and staff project personnel according to the QCP • Reviews project-specific SAPs as required • Directs QA audits
Program Chemist	<ul style="list-style-type: none"> • Implements contract requirements for chemical data collection • Reviews project-specific SAPs as required • Serves as a point of contact for the NFECSW QA Officer • Audits field and laboratory performance as required • Approves the selection of subcontract analytical laboratories and data validation companies

TABLE A.7-1
PERSONNEL AND RESPONSIBILITIES

Key Position	Responsibility
Project Manager	<ul style="list-style-type: none"> Issues and authorizes, in conjunction with SES-TECH's QC Program Manager, appointment letters describing duties/responsibilities and delegating authority to the PQCM to act on the Project Manager's behalf for site-related quality activities Issues stop-work order when necessary Monitors and controls through audits and surveillance of project activities, ensuring that relevant portions of the plan are implemented Interfaces directly with the Client to maintain an awareness in planning and scheduling processes Establishes an overall records management system for the project that ensures clarity, completeness, retrievability, and conformance to contract requirements and ensures document security Implements the approved project-specific plans Evaluates project-specific procedures and plans Evaluates the project schedule and budget
Project Chemist	<ul style="list-style-type: none"> Develops project-specific SAPs Evaluates and selects qualified subcontract analytical laboratories and data validation companies Implements chemical data QC procedures Reviews laboratory data prior to use Coordinates data validation of laboratory data Reviews data validation reports Determines whether project specifications have been met Prepares and supports report preparation
Field Sampling Personnel	<ul style="list-style-type: none"> Performs all field sampling in accordance with the CDQMP and project-specific SAP Ensures that field QC samples are collected Completes field documentation Coordinates laboratory and field sampling activities Implements field corrective actions as required

TABLE A.7-1
PERSONNEL AND RESPONSIBILITIES

Notes:

CDQMP – Chemical Data Quality Management Plan

DON – Department of the Navy

PQCM – Project Quality Control Manager

QA – quality assurance

QC – quality control

QCP – Quality Control Plan

SAP – Sampling and Analysis Plan

SES-TECH – Sealaska Environmental Services LLC and Tetra Tech FW, Inc.

TABLE A.8-1
SUMMARY OF DATA QUALITY OBJECTIVES

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
Statement of Problem	Decisions	Inputs to the Decisions	Boundaries of the Study	Decision Rules	Limits on Decision Errors	Optimize the Sampling Design
<p>UST Site 1106 is an inactive former UST site in the 11 Area of the Base.</p> <p>Site requires an additional round of groundwater sampling to further assess the extent of impacted water.</p>	<p>Is groundwater beneath the tank area impacted (i.e. above action levels in Table A.8-2)?</p>	<p>Data from previous site investigations conducted by OHM (1995).</p> <p>Results of groundwater samples analyzed for:</p> <p style="text-align: center;">TPH-d VOCs PAHs</p>	<p>UST Site 1106 is the focus of this project.</p> <p>One round of groundwater samples will be collected from three existing wells as shown in Figure 2-1 of the Work Plan.</p> <p>Fieldwork is scheduled to begin in June 2005. Project closeout is scheduled for 2007.</p>	<p>(a) If groundwater samples contain contaminants above action levels listed in Table A.8-2, then additional groundwater monitoring will be proposed.</p> <p>(b) If groundwater samples do not contain contaminants above action levels listed in Table A.8-2, then a report recommending site closure will be prepared.</p>	<p>To limit decision errors, analytical method requirements and project-specific DQOs were established. Published analytical method and laboratory-specific performance requirements are the primary determinants of DQOs for precision and accuracy.</p> <p>Field crews will review the SAP before collection of samples. The laboratory performing the analysis will be given a copy of the SAP before analysis of samples.</p> <p>Third-party data validation will be performed on all samples, except waste characterization samples.</p>	<p>Groundwater samples will be collected from all wells.</p> <p>Analyses to be performed on the samples are listed in Section 5.1 of this SAP.</p>

TABLE A.8-1
SUMMARY OF DATA QUALITY OBJECTIVES

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
Statement of Problem	Decisions	Inputs to the Decisions	Boundaries of the Study	Decision Rules	Limits on Decision Errors	Optimize the Sampling Design
					<p>Sampling and analysis protocols will be carefully followed to limit errors.</p> <p>Sample collection and analysis methods were chosen to minimize sampling errors.</p>	

Notes:

- DQO – data quality objective
- OHM – OHM Remediation Services Corporation
- PAH – polynuclear aromatic hydrocarbon
- SAP – Sampling and Analysis Plan
- TPH-d – total petroleum hydrocarbons quantified as diesel
- UST – Underground Storage Tank
- VOC – volatile organic compound

TABLE A.8-2

PROJECT REPORTING LIMITS

Parameter/Method	Analyte	Water ¹		Action Levels ²	Action Levels ³	
		RL	Unit		For Waste Sampling STLC Limit	For Waste Sampling TCLP Limit
TPH-d by EPA Method 8015B	Diesel (C ₁₀ -C ₂₄)	0.1	mg/L	0.1 ⁴	NE	NE
VOCs by EPA Method 5030B/8260B	1,1,1-Trichloroethane	5	µg/L	200	NE	NE
	1,1,2,2-Tetrachloroethane	1	µg/L	1	NE	NE
	1,1,2-Trichloroethane	5	µg/L	5	NE	NE
	1,1-Dichloroethane	5	µg/L	5	NE	NE
	1,1-Dichloroethene	5	µg/L	6	NE	700
	1,2-Dichloroethane	0.5	µg/L	0.5	NE	500
	1,2-Dichloropropane	5	µg/L	5	NE	NE
	2-Hexanone	50	µg/L	NE	NE	NE
	Acetone	50	µg/L	NE	NE	NE
	Benzene	0.5	µg/L	1	NE	500
	Bromodichloromethane	5	µg/L	100	NE	NE
	Bromoform	5	µg/L	100	NE	NE
	Bromomethane	5	µg/L	NE	NE	NE
	Carbon tetrachloride	0.5	µg/L	0.5	NE	500
	Chlorobenzene	5	µg/L	30	NE	100,000
	Chloroethane	5	µg/L	NE	NE	NE
	Chloroform	5	µg/L	100	NE	6,000
	Chloromethane	5	µg/L	NE	NE	NE
	cis-1,2-Dichloroethene	5	µg/L	NE	NE	NE
	cis-1,3-Dichloropropene	0.5	µg/L	0.5	NE	NE
	Dibromochloromethane	5	µg/L	100	NE	NE
	Di-isopropyl ether	5	µg/L	NE	NE	NE
	Ethylbenzene	0.5	µg/L	680	NE	NE
	Ethyl tert-butyl ether	5	µg/L	NE	NE	NE
	Methyl ethyl ketone	50	µg/L	NE	NE	200,000
	Methyl tert-butyl ether	1	µg/L	13	NE	NE
	Methylene chloride	5	µg/L	NE	NE	NE
	Methyl isobutyl ketone	50	µg/L	NE	NE	NE
	Styrene	5	µg/L	NE	NE	NE
	Tert-amyl methyl ether	5	µg/L	NE	NE	NE
	Tert-butyl alcohol	20	µg/L	NE	NE	NE
	Tetrachloroethene	5	µg/L	5	NE	700
	Toluene	0.5	µg/L	150	NE	NE
	trans-1,2-Dichloroethene	5	µg/L	10	NE	NE
	trans-1,3-Dichloropropene	0.5	µg/L	NE	NE	NE
	Trichloroethene	5	µg/L	5	204,000	500
	Vinyl acetate	50	µg/L	NE	NE	NE
	Vinyl chloride	0.5	µg/L	0.5	NE	200
	Xylenes (Total)	5	µg/L	1,750	NE	NE

TABLE A.8-2

PROJECT REPORTING LIMITS

Parameter/Method	Analyte	Water ¹		Action Levels ²	Action Levels ³	
		RL	Unit		For Waste Sampling STLC Limit	For Waste Sampling TCLP Limit
PAHs by EPA Method 8270C SIM or 8310	Acenaphthene	1	µg/L	NE	NE	NE
	Acenaphthylene	1	µg/L	NE	NE	NE
	Anthracene	2	µg/L	NE	NE	NE
	Benzo[a]anthracene	2	µg/L	NE	NE	NE
	Benzo[a]pyrene	0.2	µg/L	0.2	NE	NE
	Benzo[b]fluoranthene	1	µg/L	NE	NE	NE
	Benzo[g,h,i]perylene	1	µg/L	NE	NE	NE
	Benzo[k]fluoranthene	2	µg/L	NE	NE	NE
	Chrysene	2	µg/L	NE	NE	NE
	Dibenz[a,h]anthracene	1	µg/L	NE	NE	NE
	Fluoranthene	2	µg/L	NE	NE	NE
	Fluorene	2	µg/L	NE	NE	NE
	Indeno[1,2,3-cd]pyrene	1	µg/L	NE	NE	NE
	Naphthalene	1	µg/L	NE	NE	NE
	Phenanthrene	1	µg/L	1	NE	NE
	Pyrene	2	µg/L	NE	NE	NE

Notes:

¹– Water reporting limits will apply to groundwater, equipment rinsate samples, and wastewater samples analyses.

²– Action levels are based on California Drinking Water Standards, Maximum Contaminant Level, or the *Water Quality Control Plan for the San Diego County Basin Plan* (Regional Water Quality Control Board, 1994).

³– California Title 22 STLC and TCLP limits will be used for waste characterization samples.

⁴– Secondary taste and odor threshold.

µg/L – micrograms per liter

EPA – U.S. Environmental Protection Agency

mg/L – milligrams per liter

NE – not established

PAH – polynuclear aromatic hydrocarbon

RL – reporting limit

SIM – Selective Ion Monitoring

STLC – Soluble Threshold Limit Concentration

TCLP – Toxicity Characteristic Leaching Procedure

TPH-d – total petroleum hydrocarbons quantified as diesel

VOC – volatile organic compound

TABLE A.8-3
QUALITY CONTROL ACCEPTANCE CRITERIA

Method	Analyte	Accuracy Water (%R)	Precision Water (RPD)
TPH-d EPA Method 8015B	Diesel	65-135	≤ 30
	Surrogate: Hexacosane, Octacosane or Bromobenzene	65-135	N/A
VOCs EPA Method 8260B	1,1-Dichloroethene	75-125	≤ 20
	Benzene	75-125	≤ 20
	Chlorobenzene	75-125	≤ 20
	Trichloroethene	75-125	≤ 20
	Toluene	75-125	≤ 20
	Surrogates*: Dibromofluoromethane	75-125	N/A
	Toluene-d ₈	75-125	N/A
	4-Bromofluorobenzene	75-125	N/A
	1,2-Dichloroethane-d ₄	65-135	N/A
PAHs EPA Method 8270C SIM or 8310	Acenaphthene	40-130	≤ 30
	Acenaphthylene	40-130	≤ 30
	Anthracene	50-130	≤ 30
	Benzo[a]anthracene	50-130	≤ 30
	Benzo[a]pyrene	50-130	≤ 30
	Benzo[b]fluoranthene	50-130	≤ 30
	Benzo[g,h,i]perylene	50-130	≤ 30
	Benzo[k]fluoranthene	30-150	≤ 30
	Chrysene	50-130	≤ 30
	Dibenzo[a,h]anthracene	40-140	≤ 30
	Fluoranthene	50-130	≤ 30
	Fluorene	40-130	≤ 30
	Indeno[1,2,3-c,d]pyrene	30-140	≤ 30
	Naphthalene	30-130	≤ 30
	Phenanthrene	40-130	≤ 30
	Pyrene	40-130	≤ 30
	Surrogate: Terphenyl-d ₁₄	50-130	N/A

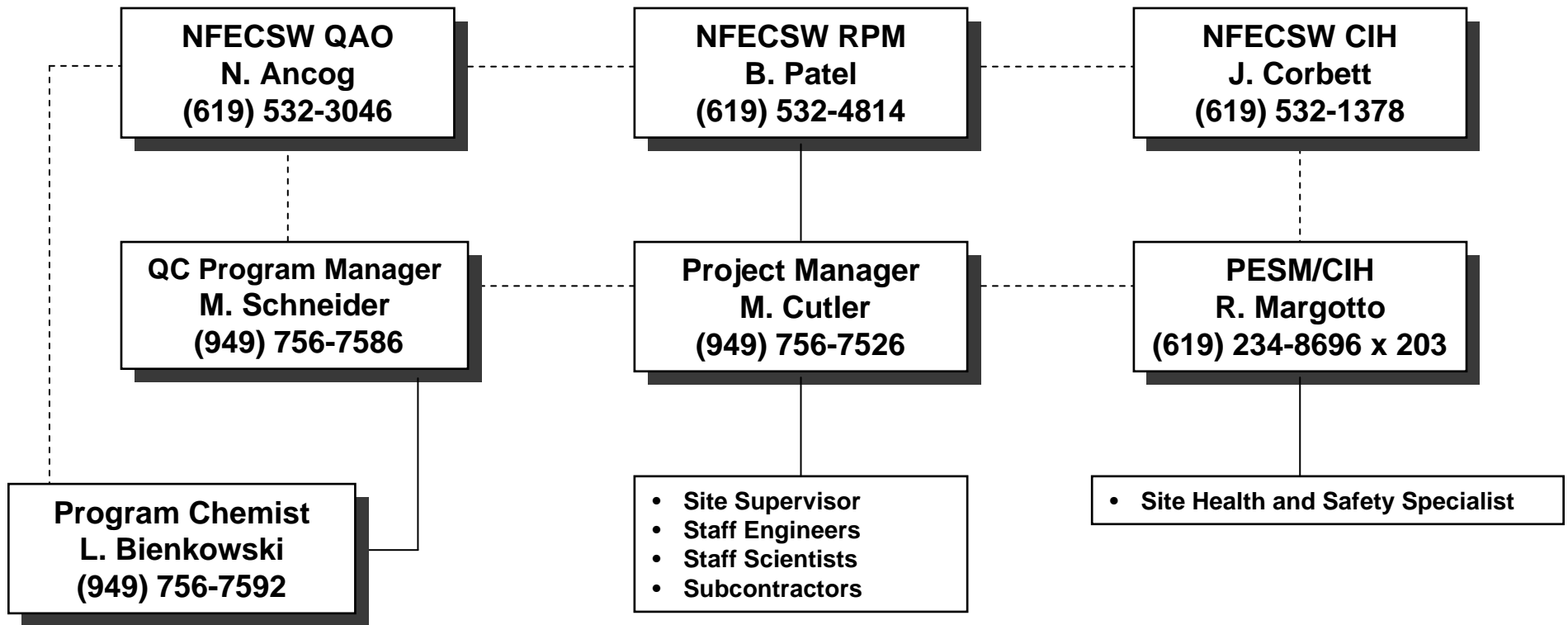
TABLE A.8-3
QUALITY CONTROL ACCEPTANCE CRITERIA

Notes:

- %R – percent recovery
- EPA – U.S. Environmental Protection Agency
- N/A – not applicable
- PAH – polynuclear aromatic hydrocarbon
- RPD – relative percent difference
- SIM – Selective Ion Monitoring
- TPH-d – total petroleum hydrocarbons quantified as diesel
- VOC – volatile organic compound
- * – only three surrogates are required

FIGURES

Figure A.7-1
Project Organization Chart



Legend

- = In regular contact and coordination
———— = Directly reports to above